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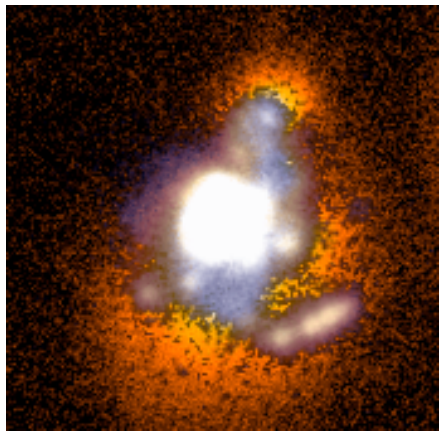
A search for properties of the cosmic reionization sources



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BAWHST, Bologna 31 January 2008

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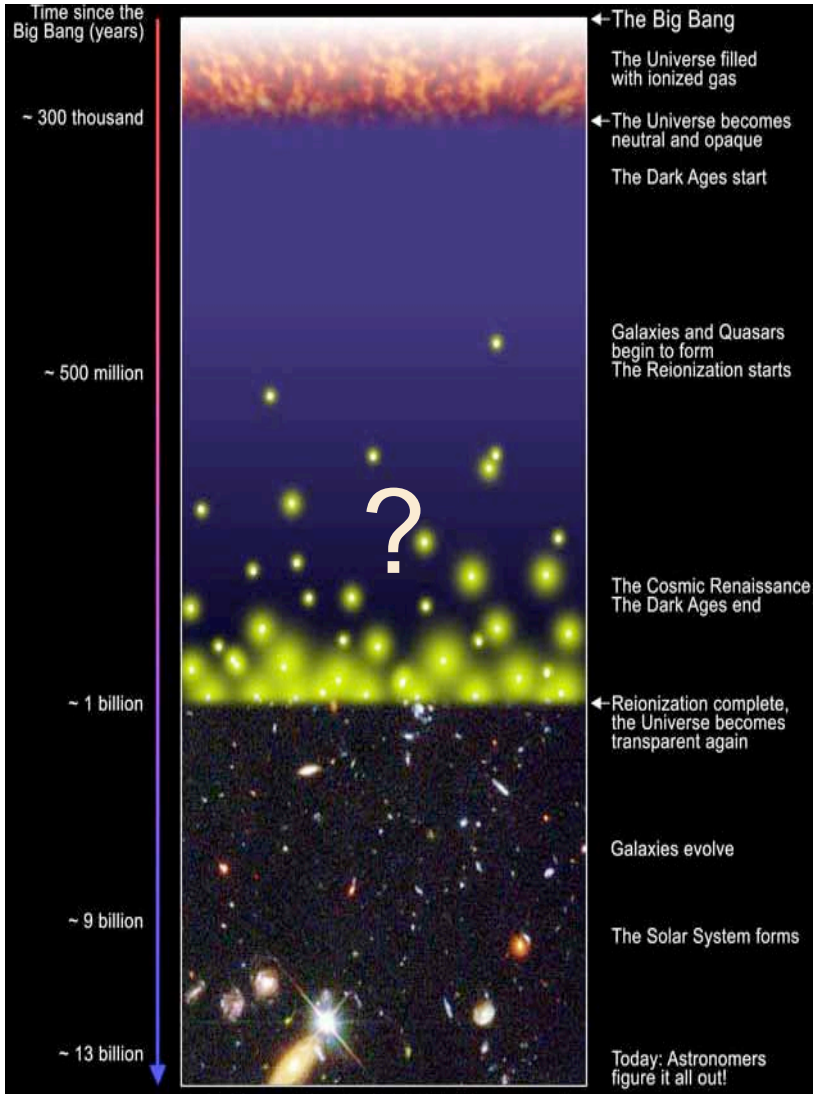
The cosmic reionization



← Recombination (z ~ 1100)

← Cosmic dark ages

←The first galaxies and stars:
Epoch of Reionization starts
(z ~ 15)

← Reionization completed
(z ~ 6)

← Today (local galaxies)

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Reionization sources

- Quasars: Too rare at z > 6
- Galaxies: Likely, but puzzingly few detections:

At z~3:

✓ Steidel et al. 2001, f_{esc}= 50%

✓ Shapley et al. 2007, f_{esc}= 40-100%

Local universe (FUSE):

✓ Bergvall et al. 2006, absolute f_{esc}= 4-10%

! but Grimes et al. 2007 find f_{esc} < 2%

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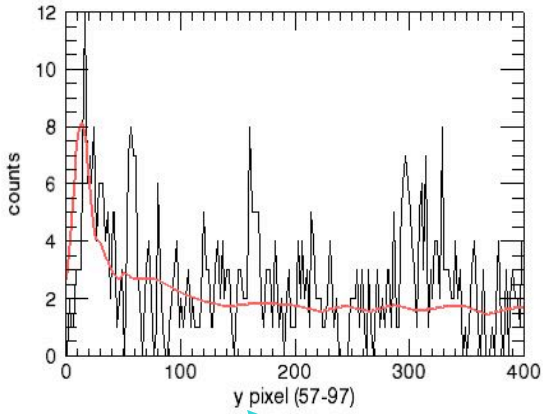
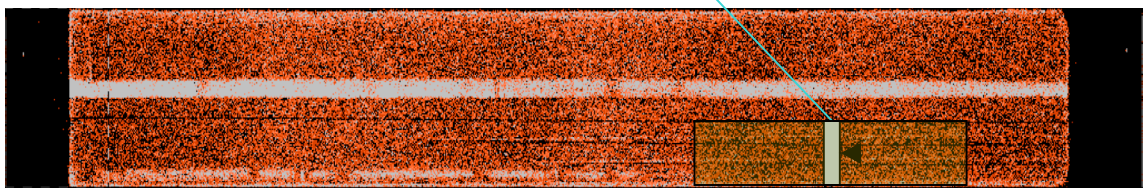
The FUSE background



Red: Scaled background model

Black: Signal on the SiC part of detector 1B, summed over 1 Å

- **Overestimated background**
- **New 2D fitting results ⇒ little leakage**
- **Wrong objects?**



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Alternative method

Instead of randomly selected powerful starbursts, use models for predictions:

- Blue colours:

⇒ ages < 10 Myr

⇒ EW(Hα) ~ 1500 Å

- Small nebular contribution:

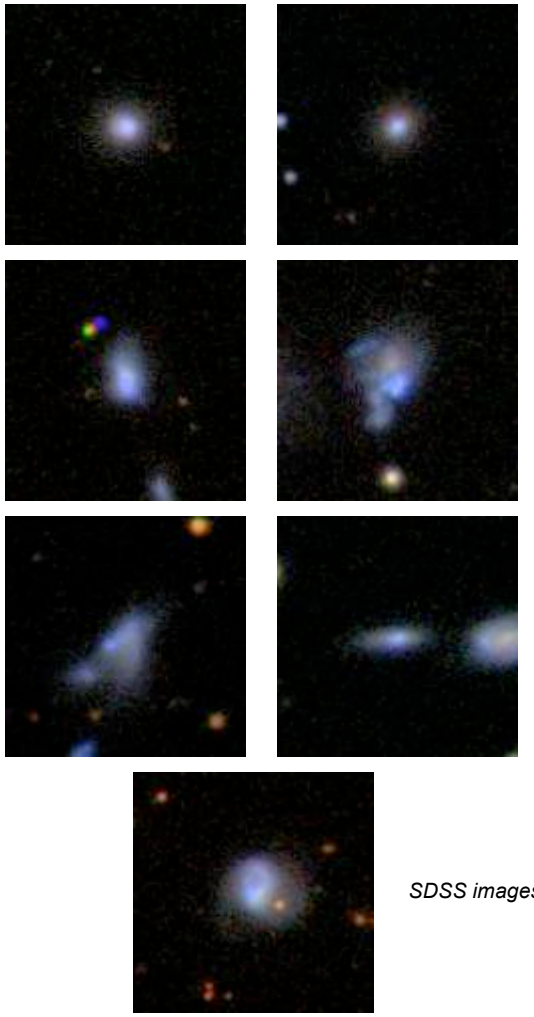
⇒ Lyman continuum leakage

or ...

⇒ Dust

If SDSS target selection

⇒ only HST!



SDSS images

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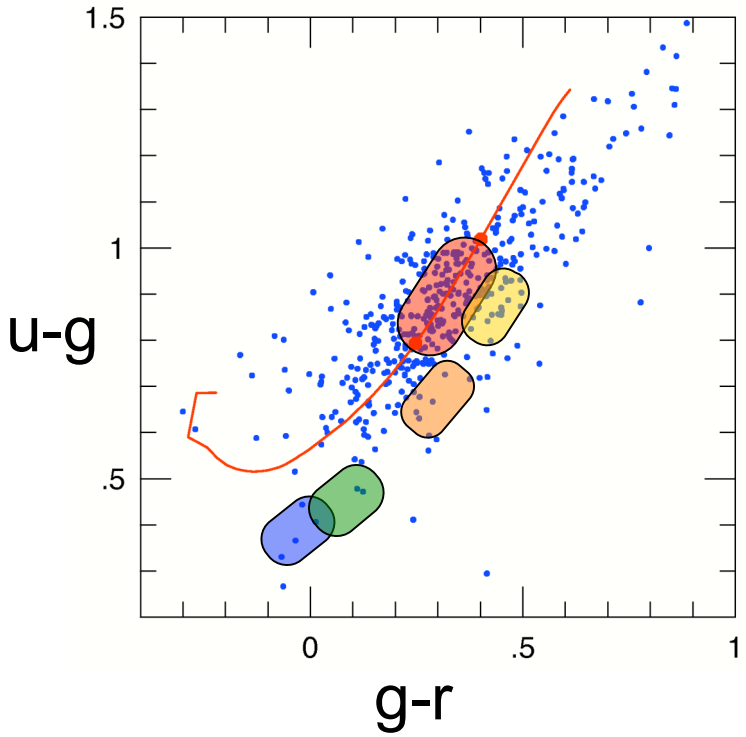
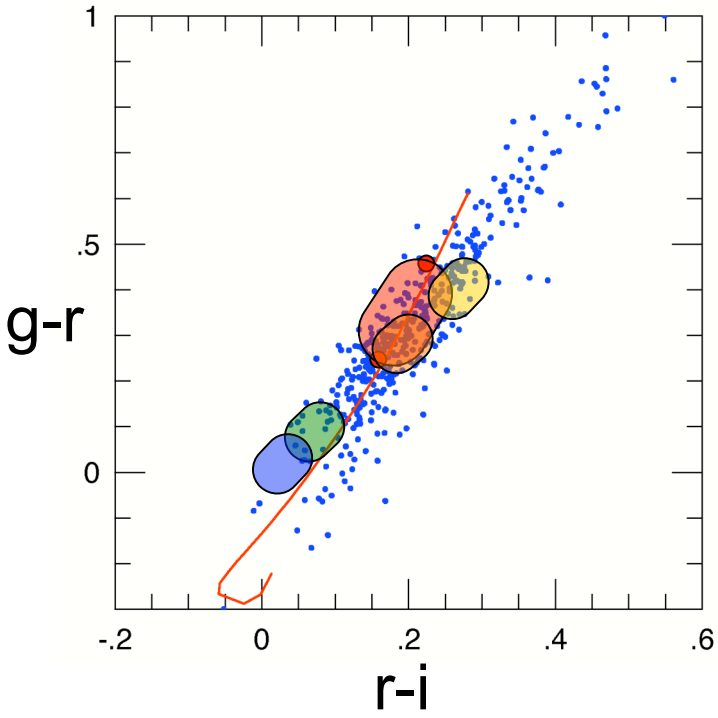
Selection





- SDSS selected galaxies:

EW(Hα) > 50 Å, z = 0.025 - 0.05

--- Model with exp. declining star formation

Time with EW(Hα) = 50 - 80 Å

Models with old population + burst:

95 % leakage

90 %

80 %

70 %

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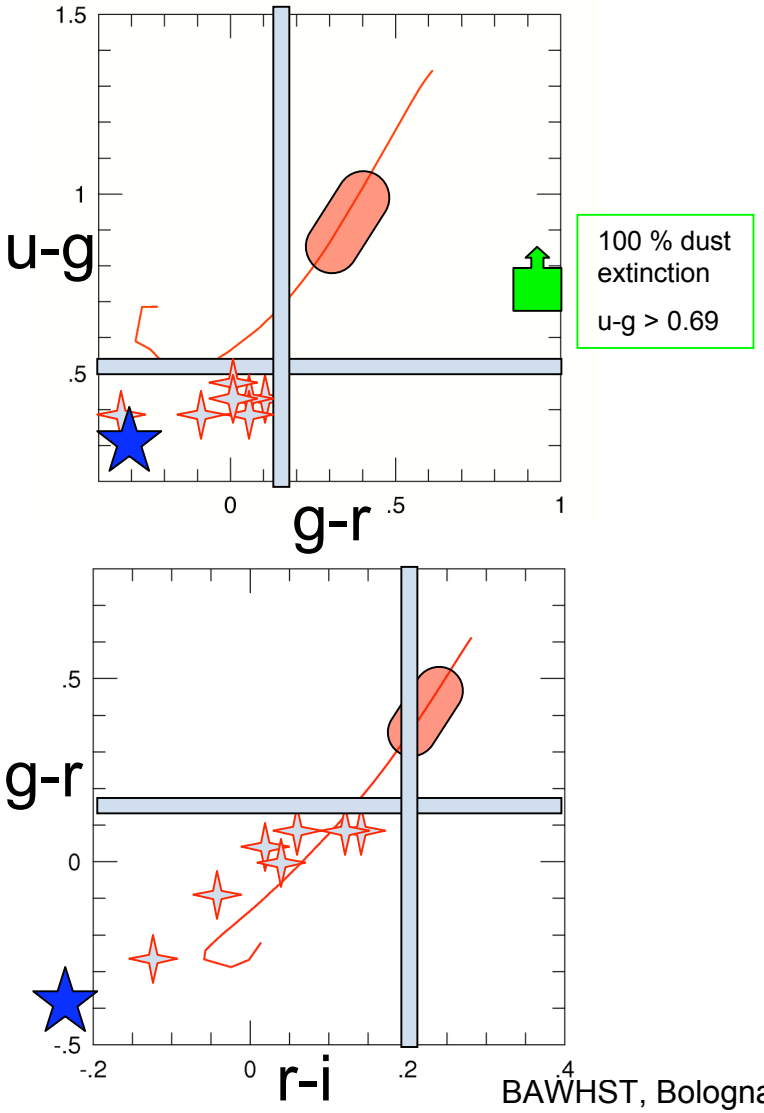
Selection



NTT observed galaxies

Purely leaking galaxy

- EW(Hα) < 300 Å
- u-g < 0.5
- g-r < 0.15
- r-i < 0.2
- [OIII]/Hβ > 2

⇒ Only 4 % of EW(Hα) > 50 Å galaxies fulfill selection criteria

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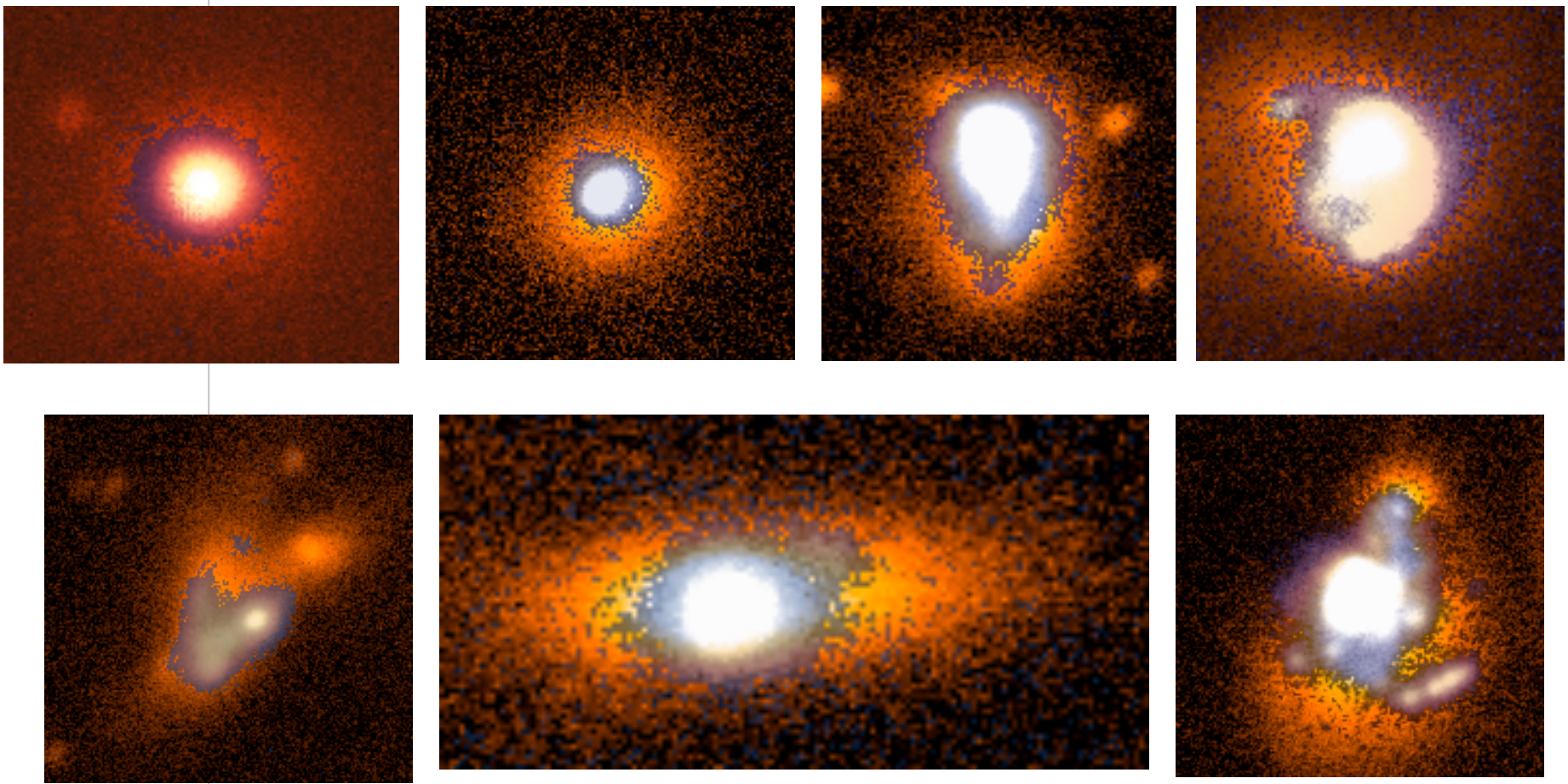
Preliminary results

Morphologies

Blue: Hα

Background: Hα offline



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Images taken with EMMI/NTT, dec 2007

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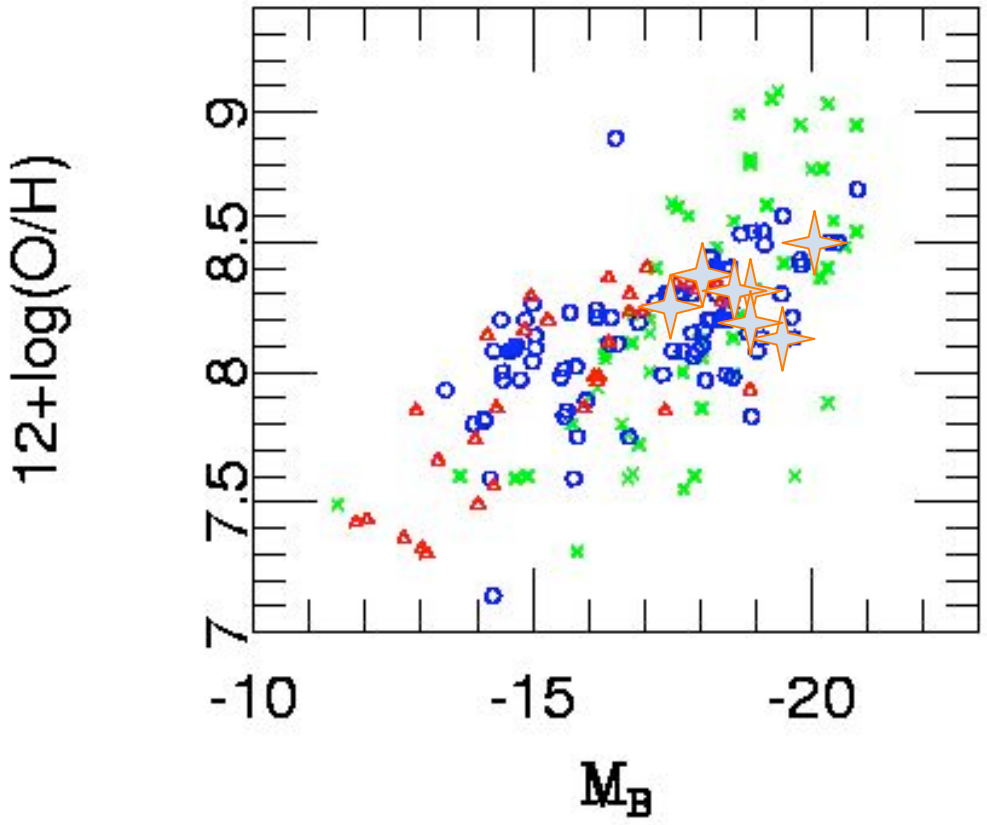
Preliminary results

Metallicities



Δ **Local irregular galaxies**

❍ **Blue compact galaxies**

x **Low surface brightness galaxies**

Observed galaxies:

M_B= -17.8 - -19.5

12+log(O/H) = 8.2-8.5

(NII method)

12+log(O/H) = 7.4-8.2

(R23 method)

⇒ Definitely interesting objects ...

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Searching with the HST

- Using the SDSS for dedicated selection of most likely leakers ⇒ only HST in far-UV!
- COS fuv, G140L (also includes Lyα line), timetag mode
- z = 0.35-0.40 to optimize COS sensitivity at LyC rest wavelengths ~ 900 Å
- For z=0.35,0.38,0.41, narrowband Hα with WFC3 is possible
- Or: COS fuv G130M at z~0.3 (no Lyα)
- If COS calibration favourable, in future cycles also z~0.03 NTT observed galaxies

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Summary

- Previous observations of local galaxies show low escape fractions
- Models predict high f_{esc} (even after dust absorption) for ”new” object selected from SDSS with leakage optimized technique
- NTT sample verify promising objects at z~0.03
- Next cycle: Use COS on SDSS selected galaxies with same properties at z~0.3 - 0.4
- Future cycles?: Use COS on NTT sample